Natural Resources and Environmental Protection Cabinet
Department for Environmental Protection
Division of Waste Management
Hazardous Waste Branch
14 Reilly Road
Frankfort, KY 40601

To receive this newsletter by email,
contact Lauren McDonald at (502) 564-6716 or lauren.mcdonald@mail.state.ky.us

The ***Kentucky Environmental Oversight News*** is published quarterly by the Kentucky Department for Environmental Protection's Division of Waste Management. It features information regarding environmental remediation activities at the Paducah Gaseous Diffusion Plant site and related topics. Subscriptions are free and may be requested from Lauren McDonald (newsletter editor), Hazardous Waste Branch, Division of Waste Management, 14 Reilly Road, Frankfort, KY 40601 (502) 564-6716, FAX (502) 564-2705.

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For more information:
Contact Gaye Brewer
Division of Waste Management
P.O. Box 1410, Bldg. C-103
West Paducah, KY 42086
(270) 441-5278
FAX (270) 441-5277

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Oversight News

Newsletter of the Commonwealth's Environmental Oversight of the Paducah Gaseous Diffusion Plant

Tackling TCE: Winter Field-Start Anticipated for Six-Phase Treatability Study

The Six-Phase Heating treatability study to take place at the southeast corner of the C-400 Building is nearing its operational phase. The study will test six-phase heating's success at removing trichloroethene (TCE) that has been released underground at the Paducah Gaseous Diffusion Plant. The system is designed to convert the TCE into a vapor that can be captured and treated. For more information about how the system works, see the sidebar on page 3.

Project leaders expect to be able to test or begin operating the system in early February. The seven electrodes that will provide the heat to remove subsurface TCE were installed by the end of November, as were all of the planned monitoring wells and piezometers.

The southeast corner of the C-400 building, where six-phase heating is being installed to treat TCE contamination.
Photo by **Gaye Brewer,** *Ky. Division of Waste Management*

At press time, DOE was in the process of receiving all of the aboveground components that will complete the system. These components include a power control unit, condenser, carbon air filtering material and a cooling tower.

The vessels that house the carbon air filtering material are rather large, each containing several thousand pounds of the activated carbon. Once energized by the six-phase system, all vapors removed from the ground will pass through the carbon media vessels, which will remove the TCE and other volatile organics from the air stream.

At the end of the treatability study, the TCE and other volatile organic compounds captured by the air filtering vessels will be

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Tackling TCE: Lasagna™ Satisfies Cleanup Goal

On Oct. 21, 2002, the Kentucky Division of Waste Management approved the final remedial action report for Lasagna™ Phase IIB, bringing the project to an official end.

The state's approval certifies that all conditions of the Lasagna Record of Decision (ROD) have been satisfied. The Lasagna remedial action represents the first successful cleanup of an area suspected of acting as a source of trichloroethene (TCE) contamination in groundwater.

The Lasagna site was one of several confirmed or suspected TCE "source zones" at the Paducah Gaseous Diffusion Plant (PGDP). These source zones contain significantly high levels of TCE in the soil. The soil releases TCE into the underlying groundwater on a continuing basis, resulting in extensive groundwater contaminant plumes.

The Lasagna technology used a process called electro-osmosis to cleanse TCE-contaminated soils and groundwater at the former cylinder drop test area. This area was once used to chill uranium hexafluoride cylinders in a TCE/dry ice bath prior to testing their integrity (by hoisting the cylinders up in the air and dropping them onto a concrete pad). Over time, TCE leaked from the bath pit into the subsurface soils, leaving TCE concentrations as high as 1,500 parts per million (ppm) in the soil.

The Lasagna system is designed to degrade the TCE in place into less toxic compounds. It works by using an electrical current to transport dissolved contamination through treatment zones consisting of iron filings (material made by grinding up old engine blocks) installed into the ground. The dissolved TCE and iron filings react in such a way that the chlorine atoms are stripped from the TCE molecules, leaving in their place a less toxic compound such as ethene or ethane.

The technology takes its name from the way the parallel arrangement of electrodes and treatment zones resembles layers of lasagna. It's thought to be most practical for sites where contamination is confined to relatively impermeable soils.

Lasagna was tested at Paducah on two separate occasions prior to its selection as the remedy for the cylinder drop test area. Both tests took place at the drop test site. Phase I began in January 1995 and ran for 120 days. A larger-scale test, Phase IIA, ran for nearly a year (August 1996 – July 1997) and required the installation of electrodes and treatment zones over a 20-by-30-foot area to depths of 45 feet—the maximum depth required to remediate the site.

When Phase IIA proved successful, the decision was made to move forward with a full-scale deployment of the technology. Phase IIB, which covered an area about 75 feet by 85 feet, was the final phase of treatment.

The ROD for Phase IIB required soils to be treated until the TCE concentration was no higher than 5.6 ppm. Over its several years of operation, Lasagna surpassed its goal by reducing the TCE levels in soil to an average of 0.38 ppm, with a maximum detected value of 4.5 ppm.

The cleanup standard was based on groundwater modeling that indicates that TCE concentrations of 5.6 ppm in the soil in this area will not cause groundwater at the plant's fence line to exceed the TCE drinking water standard (5 micrograms per liter, or parts per billion).

Project leaders hope that, with the use of even more robust cleanup technologies, the success at the drop test area can be repeated at other contaminated areas of the PGDP.

By **Todd Mullins**, *Ky. Division of Waste Management, Hazardous Waste Branch*

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...is the new web address for the Kentucky Division of Waste Management. To view more information about the Paducah Gaseous Diffusion Plant, follow the links to the **Hazardous Waste Branch**.

Six-Phase Heating

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removed from the carbon material and disposed appropriately.

Although the study will only operate for a maximum of 130 days, project scientists believe this will be enough time to determine how well the technology would perform over longer timeframes. Everyone associated with this study is very hopeful that six-phase heating will provide an effective means of extracting the vast amounts of TCE that exist in the subsurface soils at the PGDP.

By **Todd Mullins**, *Ky. Division of Waste Management, Hazardous Waste Branch*

What is six-phase heating?

Six-phase heating is an innovative technology that uses electricity to heat soils contaminated with volatile organic compounds (VOCs).

What are VOCs?

Volatile organic compounds evaporate readily at room temperature. As temperature rises above room temperature, greater and greater proportions of these liquids vaporize.

How does six-phase heating work?

Six electrodes are installed in a hexagonal array to a desired depth in the contaminated soils. As electricity flows between the six hexagonally arranged electrodes and a seventh electrode, VOC-contaminated soil and groundwater are heated, which causes the VOCs to vaporize. Vacuum wells extract the vapor, which is then treated before being discharged into the atmosphere.

Where will the study take place?

The system has been installed near the southeast corner of the C-400 building, where field investigations identified a zone of TCE contamination.

Kentucky Natural Resources Secretary Hank List (right) speaks briefly with political leaders (left to right: Kentucky Gov. Paul Patton and U.S. Sens. Jim Bunning and Mitch McConnell) on the state's role in overseeing the cleanup of the Paducah Gaseous Diffusion Plant.
Photo by **Brian Begley**, *Ky. Division of Waste Management*

Plant Marks 50 Years

The Paducah Gaseous Diffusion Plant celebrated its 50 years of history in a special ceremony on Oct. 24, 2002. The celebration, which was attended by such public officials as Kentucky Gov. Paul Patton, U.S. Sens. Mitch McConnell and Jim Bunning, and U.S. Rep. Ed Whitfield, included the unveiling of a new, three-panel floodwall mural depicting the plant's role in Paducah history.

Energy Secretary Spencer Abraham was the keynote speaker at the ceremony. In his remarks, he acknowledged many forms of community support that contributed to the plant's success, such as the dedicated work force and the construction of support facilities, including the Shawnee Steam Plant, Joppa Steam Plant and Honeywell conversion facility.